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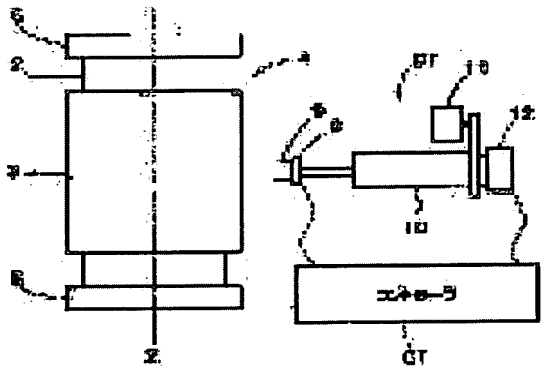
(54) MANUFACTURING METHOD OF PILLAR HOLDING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To adjust the inside diameter of a part for holding at least a cushioning member of a cylindrical member appropriately, and hold appropriately by press-inserting a pillar wounded with the cushioning member into the cylindrical member.
SOLUTION: The cushioning member is compressed by pressing the cushioning member in the direction perpendicular to the axis of the pillar by a pressing body 9 in a state of winding the cushioning member (cushion mat 3) at the outer periphery of the pillar (catalyst carrier 2), the surface pressure of the cushioning member against the pillar is detected, and the predetermined distance between the axis of the pillar and the end of the pressing body is measured when the surface pressure reaches a predetermined value. The pillar wounded with the cushioning member is press-inserted into the cylindrical member of which the diameter is previously contradicted or expanded so that the actual diameter of the inside of the part holding at least the cushioning member becomes the predetermined distance.



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CLAIMS

[Claim(s)]

[Claim 1] In the manufacture approach of the prism supporting structure which holds a prism through a buffer member in tubed part material, where said buffer member is wound around the periphery of said prism While pressing said buffer member in the direction which intersects perpendicularly to the axis of said prism with a press object and compressing said buffer member Detect the planar pressure of said buffer member to said prism, and the predetermined distance between the axis of said prism in case this planar pressure serves as a predetermined value, and the tip of said press object is measured. To said tubed part material which reduced the diameter of or expanded beforehand the diameter of said prism which wound said buffer member so that the substantial radius inside [which holds said buffer member at least] a part might serve as said predetermined distance, where said buffer member is wound around the periphery of said prism The manufacture approach of the prism supporting structure characterized by pressing fit.

[Claim 2] Said predetermined value is the manufacture approach of the prism supporting structure according to claim 1 characterized by setting up based on the thrust to the coefficient of static friction of the external surface of said prism and the coefficient of static friction of the inside of said tubed part material, and said buffer member of said press object.

[Claim 3] The manufacture approach of the prism supporting structure according to claim 1 characterized by detecting the planar pressure of said buffer member to said prism while covering the perimeter of said buffer member, installing two or more said press objects, pressing said buffer member in the direction which intersects perpendicularly to the axis of said prism by at least one of these two or more of the press objects and compressing said buffer member.

[Claim 4] Said two or more press objects are the manufacture approaches of the prism supporting structure according to claim 3 characterized by covering the

perimeter of said buffer member, installing the press object of this long member, and changing while constituting from a long member of the die length equivalent to the part of said tubed part material which holds said buffer member at least.

[Claim 5] The manufacture approach of the prism supporting structure according to claim 4 characterized by pressing fit in said tubed part material said prism which winds said buffer member in a condition until it restores to the condition before compression from a compression condition in case said planar pressure serves as a predetermined value, and changes.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacture approach suitable as the manufacture approach of a catalytic converter of holding the catalyst support of a prism through a buffer mat in tubed part material, concerning the manufacture approach of the prism supporting structure which holds a prism through a buffer member in tubed part material.

[0002]

[Description of the Prior Art] The prism supporting structure which holds the prism of honeycomb structure which has a filtering function to a fluid through a buffer member in metal tubed part material is used as a fluid processor, and purification of various fluids is presented with it. for example, in the exhaust air system of an automobile, the catalytic converter and the diesel particulate filter (henceforth DPF) are carried, and the prism of the brittle honeycomb structure made from a ceramic is used as catalyst support or a filter (naming generically -- support -- saying -- the following and ********** -- unacquainted ******** is represented). It is held in metal tubed part material through buffer members, such as a ceramic mat, a fluid processor is constituted, and the prism of this honeycomb structure has a catalytic converter as that example. And as the manufacture approach of the prism supporting structure like this catalytic converter, the manufacture approach by the press fit which holds a buffer member in tubed part material while compressing winding and this buffer member is common on the periphery of catalyst support.

[0003] For example, in the following patent reference 1 (JP,2001-355438,A), it faces pressing fit in a maintenance cylinder the catalyst support by which the periphery was equipped with maintenance material, the outer diameter of catalyst support is measured, and the manufacture approach of the catalytic converter which presses fit

the catalyst support by which the maintenance cylinder which has the bore which suits this measurement value was equipped with maintenance material is proposed. Moreover, the outer diameter of the maintenance material with which the periphery of catalyst support was equipped is measured, and the approach of pressing fit the catalyst support by which the maintenance cylinder which has the bore which suits this measurement value was equipped with maintenance material is also proposed. Furthermore, it faces measuring the outer diameter of maintenance material, and measuring, where a predetermined pressure is applied is also proposed. And in this patent reference 1, the material of many maintenance cylinders by which bores differ is prepared beforehand, and choosing what has a proper bore out of it is proposed.

[0004] In addition, diameter reduction processing by spinning is indicated by the following patent reference 2 quoted as a conventional technique in the patent reference 1. Furthermore, eccentric spinning is indicated by the following patent reference 3 as necking processing to the edge of the tubed part material after press fit, and inclination spinning is indicated by the following patent reference 4.

[0005]

[Patent reference 1] JP,2001-355438,A [the patent reference 2] JP,2000-45762,A [the patent reference 3] The patent No. 2957153 official report [the patent reference 4] The patent No. 2957154 official report [0006]

[Problem(s) to be Solved by the Invention] Although "It is desirable measuring the outer diameter of the maintenance material 3 in the condition of having made the pressure equivalent to the pressure (henceforth holding pressure) which joins the maintenance material 3 acting on the maintenance material 3 when catalyst support 2 is pressed fit in the maintenance cylinder 1" is indicated by the patent reference 1 shown above In such a press fit approach, it is impossible to presume the pressure applied to maintenance material at a back process, and the explanation about this point is not found, either. That is, when catalyst support 2 is pressed fit in the maintenance cylinder 1, the publication of the purport which makes a pressure equivalent to the pressure which joins the maintenance material 3 the condition of having made it acting on the maintenance material 3 does not escape from the region of a wish, and the indication which can be understood that implementation is otherwise possible is not found.

[0007] Furthermore, what has the bore which can make a proper pressure act on the maintenance material 3 after press fit as a material of "maintenance cylinder 1 at catalyst support 2 is used for the patent reference 1 shown above. If this prepares beforehand many materials with which bores differ and an example is taken by the thing which can attain by choosing what has a proper bore out of it and which is done for" purport publication When it presses fit, it is clear that it is not what adjusts the

bore of the maintenance cylinder 1 according to the result of having measured the outer diameter of the maintenance material 3 (although this having been impossible as mentioned above, even if possible), in the condition of having made the pressure equivalent to the pressure which joins the maintenance material 3 acting on the maintenance material 3, either. About what kind of measurement result is used [how] how after all by measuring the outer diameter of the maintenance material 3 in the condition of having made the pressure acting, it is not certain.

[0008] On the other hand, generally in the manufacture approach by old press fit, the gap of the outer diameter of catalyst support and the bore of tubed part material is set up on the basis of the pack density (called a GBD value) of a buffer member slack buffer mat. Although this GBD value is weight / restoration gap dimension per unit area, planar pressure (unit: pascal) occurs according to the pack density of a buffer mat and catalyst support is held by this planar pressure, planar pressure must be adjusted to the value which can be held so that this may not move in the inside of tubed part material to the catalyst support which vibration and the exhaust-air-pressure force join while adjusting it to the value which naturally does not exceed the reinforcement of ** catalyst support. For that, a buffer member is pressed fit with the GBD value of design within the limits, and this GBD value must be maintained between the life cycles of a product.

[0009] However, in the manufacture approach by the above-mentioned general press fit, it is superimposed on the error of weight per unit area of the error of the outer diameter of catalyst support inevitably produced on manufacture, the error of the bore of tubed part material, and the buffer member (buffer mat) infixed among these, and becomes the error of a GBD value. Therefore, it cannot become the realistic solution for mass production to find out the optimal combination of each part material for making the error of this GBD value into min. Moreover, the GBD value itself is influenced by the property and individual difference of a buffer member, moreover it is based on the measured value on a flat surface, and does not express the measured value in the condition of having been closely wound to catalyst support. For this reason, to press catalyst support fit in tubed part material appropriately is desired, without being dependent on a GBD value like before.

[0010] When the holding power needed here in order to hold catalyst support in the predetermined location in tubed part material is explained, the holding power of the direction of a path of tubed part material is compression stability of the buffer member which works in the direction which intersects perpendicularly to the external surface of catalyst support, and the inside of tubed part material. On the other hand, since the force of shaft orientations arises according to vibration or the exhaust-air-pressure force in catalyst support and a buffer member to the tubed part

material fixed to the exhauster of an automobile, the holding power of the shaft orientations (longitudinal direction) of tubed part material is required as force which resists this, and this serves as a place which the frictional force between a buffer member and catalyst support and the frictional force between a buffer member and tubed part material **.

[0011] The frictional force between the above-mentioned buffer member and catalyst support and the frictional force between a buffer member and tubed part material are expressed as the product which multiplied the compression stability (planar pressure) of a buffer member by the coefficient of static friction between the external surface of catalyst support, and a buffer member, and a product which multiplied the compression stability (planar pressure) of a buffer member by the coefficient of static friction between the inside of tubed part material, and a buffer member, respectively. At this time, the frictional force between a member with a lower coefficient of static friction and a buffer member becomes dominant as holding power of shaft orientations (longitudinal direction). Therefore, in order for required frictional force to become clear and to secure this about the catalyst support and the tubed part material the coefficient of static friction is proved that it is, it is necessary to make planar pressure to a buffer member high but, and within the limit of the planar pressure to a buffer member, when catalyst support is brittle, in order to avoid that the load of the direction of a path becomes excessive, it is necessary to set up so that the holding power of shaft orientations can be secured.

[0012] It **, and the planar pressure to a buffer member is set up based on the coefficient of static friction of the member of the lower one of the coefficient of static friction of the external surface of catalyst support, and the coefficients of static friction of the inside of tubed part material, and should just set up the bore of a tubed member which is a part for a buffer member attaching part at least according to the planar pressure. It faces holding catalyst support through a buffer member in tubed part material. Namely, the most suitable control parameter It is the planar pressure (unit: pascal) given to catalyst support through a buffer member (buffer mat). The thing of the tubed part material which should detect the value which carries out direct detection of this planar pressure, or corresponds to this uniquely, or the approximated value, and should be pressed fit based on that detection result for which the bore for a buffer member attaching part is set up at least is desirable.

[0013] However, in the conventional approach, it will be said that the management based on the above-mentioned GBD value is common, and presumed management by the substitution value is performed so to speak. For this reason, it not only says that it is superimposed on a presumed factor and an error becomes unescapable, but as a result, the holding power by the frictional force between a buffer member and catalyst

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support and the holding power by the frictional force between a buffer member and tubed part material are mixed up, and the dimension relation of each part article is set up. Moreover, since it is inevitably superimposed on the presumed factor over a back process and an error arises also in the measurement in the patent reference 1 shown above, it is necessary to take a certain cure.

[0014] Then, this invention makes it a technical problem to adjust appropriately the bore of the part which holds a buffer member at least of tubed part material, to press fit the prism which wound the buffer member in this tubed part material, and to enable it to hold appropriately in the manufacture approach of the prism supporting structure which holds a prism through a buffer member in tubed part material.

[0015]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention is in the condition which wound said buffer member around the periphery of said prism in the manufacture approach of the prism supporting structure which holds a prism through a buffer member like in tubed part material according to claim 1. While pressing said buffer member in the direction which intersects perpendicularly to the axis of said prism with a press object and compressing said buffer member Detect the planar pressure of said buffer member to said prism, and the predetermined distance between the axis of said prism in case this planar pressure serves as a predetermined value, and the tip of said press object is measured. It is in the condition which wound said buffer member around the periphery of said prism to said tubed part material whose diameter was reduced the diameter of or expanded beforehand so that the substantial radius inside [which holds said buffer member at least] a part may serve as said predetermined distance in said prism which wound said buffer member, and suppose that it presses fit.

[0016] In the manufacture approach of the above-mentioned prism supporting structure, said predetermined value is [like] good to constitute so that it may set up based on the thrust according to claim 2 to the coefficient of static friction of the external surface of said prism and the coefficient of static friction of the inside of said tubed part material, and said buffer member of said press object.

[0017] In the manufacture approach of the above-mentioned prism supporting structure, while covering the perimeter of said buffer member, installing two or more said press objects like, pressing said buffer member in the direction according to claim 3 which intersects perpendicularly to the axis of said prism by at least one of these two or more of the press objects and compressing said buffer member, it is good to constitute so that the planar pressure of said buffer member to said prism may be detected. Furthermore, said two or more press objects are good while constituting that of continuing and installing the press object of this long member in the perimeter

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of said buffer member side by side from a long member of the die length which is [like] equivalent to the part of said tubed part material which holds said buffer member at least according to claim 4.

[0018] It is good also as pressing fit in said tubed part material said prism which winds said buffer member in a condition until it restores to the condition before compression from a compression condition according to claim 5 in case said planar pressure serves as a predetermined value like, and changes in the manufacture approach of the prism supporting structure given in above-mentioned claim 4. Thereby, since said buffer member reverts completely and will be in an early compression condition after pressing fit in said tubed part material, said prism which winds said buffer member and changes can be pressed fit easily. In addition, also when pressing fit in said tubed part material after restoring to the condition before said buffer member compressing, since the diameter is beforehand reduced [the diameter] or expanded so that the substantial radius inside [which holds said buffer member at least] a part may serve as said predetermined distance, said tubed part material is pressed fit appropriately, without being compressed excessively.

[0019]

[Embodiment of the Invention] The manufacture approach of a catalytic converter is explained with reference to a drawing as the concrete 1 mode about the manufacture approach of the prism supporting structure which holds a prism through a buffer member in the above-mentioned tubed part material. First, as shown in drawing 1 , the buffer mat 3 which constitutes the buffer member of this invention is further fixed to the periphery of the catalyst support 2 which constitutes the prism of this invention on an inflammable tape etc. winding and if needed. The one article 4 of drawing 1 is constituted by this. In this case, it is good to form heights and a crevice in the both ends of the buffer mat 3, as shown in drawing 1 , and to use the general winding approach that these fit in mutually.

[0020] In this operation gestalt, although it consists of prisms of the honeycomb structure made from the ceramics, metal is sufficient as catalyst support 2, and it does not ask the quality of the material and a process. Although the buffer mat 3 is constituted from this operation gestalt by the alumina mat which does not almost have expansion by heat, it is good also as the vermiculite-type buffer mat of a thermal-expansion mold, and a buffer mat which combined them. Moreover, the inorganic fiber mat with which it does not sink in is sufficient as a binder. In addition, since planar pressure changes with the existence and the content of a binder, it is necessary to consider this in the below-mentioned planar pressure setup. Or the wire mesh which composed the metal thin line may be used, and it may be used combining a ceramic mat. Furthermore, you may combine with the retainer of the shape of them

and a metal circular ring, the seal ring made from a wire mesh, etc.

[0021] Next, as shown in drawing 2 , the above-mentioned one article 4 is grasped between the clamp equipment 5 of a pair, the planar pressure given to catalyst support 2 while pressing catalyst support 2 through the buffer mat 3 with the press object 9 of a measuring device DT in the direction which intersects perpendicularly to the axis Z is detected, and the distance L between the axis Z of catalyst support 2 in case this planar pressure serves as a predetermined value, and the press object 9 is measured. And after measurement, after returning the press object 9 to a original location, grasping by clamp equipment 5 is canceled. In addition, in this measurement stroke, it is not necessary to measure the dimension and characteristic value of catalyst support 2 and buffer mat 3 the very thing. Hereafter, the clamp equipment 5 and the measuring device DT which are used with this operation gestalt are explained.

[0022] Clamp equipment 5 consists of collet chucks, the vertical edge of catalyst support 2 is pinched by this, and the axis Z is set to a predetermined measuring point. The measuring device DT of this operation gestalt is equipped with the ball-screw type actuator 10 of motor 11 drive, the press object 9 supported through the load cell 8 at the tip, and the location detection means slack rotary encoder 12 arranged at the back end. The detecting signal of a load cell 8 and a rotary encoder 12 is inputted into an electronic control (henceforth a controller) CT, and while it is changed into the various below-mentioned data and memory (not shown) memorizes, the motor 11 is constituted so that drive control may be carried out by Controller CT.

[0023] The press object 9 moves in the direction (longitudinal direction of drawing 2) which intersects perpendicularly to the axis Z of catalyst support 2, and it is arranged so that this can be compressed after contacting the buffer mat 3. Since the contact area of the press object 9 is known, reaction force when the measuring object slack catalyst support 2 and the buffer mat 3 are pressed with this press object 9 is detected by the load cell 8 as planar pressure to catalyst support 2, and it is inputted into Controller CT. In Controller CT, the detecting signal of a load cell 8 is converted into a planar pressure value, is memorized by memory, and is compared with the predetermined planar pressure value inputted beforehand separately. Moreover, the amount of attitudes and halt location of the press object 9 are detected by the rotary encoder 12 as rotation information on a ball screw (not shown), and it is inputted into Controller CT. In Controller CT, the detecting signal of a rotary encoder 12 is changed into the amount of attitudes of the press object 9, and the value of a halt location on real time, and is memorized by memory. In addition, between these detection means and Controllers CT, you may connect electrically and may connect optically.

[0024] By driving as follows the measuring device DT constituted as mentioned above, the relation between the distance between the axis Z of catalyst support 2 and the

press object 9 and the planar pressure then given to catalyst support 2 can be measured. That is, as the press object 9 is advanced from an initial valve position (it moves leftward [of drawing 2]), some buffer mats 3 are pressed and it is shown in drawing 3 , a load cell 8 detects the compression reaction force of the buffer mat 3 in the press section, and a location (the location SP of Axis Z to the distance L shown in drawing 3) when this detection result reaches a predetermined value is detected. This location (location of Axis Z to the distance L) is equivalent to the location of the internal surface for buffer mat 3 attaching part (diameter reduction processing back) of tubed part material later mentioned in case the planar pressure of the buffer mat 3 after becoming a product serves as a predetermined value. Therefore, the relation between the thrust given to catalyst support 2 and the reaction force (planar pressure) produced by it is beforehand memorized in the memory of Controller CT, the detecting signal (reaction force) of a load cell 8 is changed into a planar pressure value based on this relation, the press object 9 is advanced to an above location (location of Axis Z to the distance L), comparing this with a predetermined planar pressure value, and the migration length of the press object 9 is found.

[0025] It **. From the predetermined distance between the initial valve position at the tip of the press object 9, and the axis Z of catalyst support 2 If the migration length of the press object 9 detected by the rotary encoder 12 is deducted, the location at the tip of the press object 9 (Namely, the distance L from Axis Z) can be judged. This location It will be called the location of the internal surface for buffer mat 3 attaching part (diameter reduction processing back) of the tubed part material in a product condition (namely, condition that the planar pressure to catalyst support 2 is held with the predetermined planar pressure value within the tubed part material mentioned later). Thus, the location (the location SP of Axis Z to the distance L shown in drawing 3) used as a predetermined planar pressure value can be judged, without [without it measures the dimension and characteristic value of catalyst support 2 and the buffer mat 3 according to an individual according to this operation gestalt, and] using the above-mentioned GBD value. That is, since the distance L between the axis Z of the above-mentioned catalyst support 2 and the tip of the press object 9 serves as a value which also took the error of weight into consideration as a result per unit area of not only the outer-diameter error of catalyst support 2 but the buffer mat 3, it is not necessary to measure these errors separately.

[0026] In addition, although degree process is equipped with the above-mentioned distance L and the memory of Controller CT memorizes, you may constitute so that it may display if needed. Moreover, it is not necessary to make it not necessarily stop by the position (location of Axis Z to the distance L shown in drawing 3), and the press object 9 may be retreated continuously as it is after detecting this location, and

further, it may be constituted so that grasping by clamp equipment 5 may be made to cancel synchronizing with retreat of this press object 9.

[0027] Furthermore, as shown in drawing 4 , it is good also as constituting so that multipoint measurement by two or more measuring devices DT which arrange two or more press object 9x to a radial, and contain these in the surroundings of the axis Z of catalyst support 2 is performed, or elegance 4 may clamp equipment 5 and really be rotated (indexing) and multipoint measurement may be performed to the surroundings of Axis Z, and asking for the average of each measured value. Since it is necessary especially to perform multipoint measurement according to the configuration of catalyst support 2 when catalyst support 2 is not a circular cross section, it is desirable to arrange two or more measuring devices DT. In addition, although it is constituted from the shaft-orientations die length of the buffer mat 3 by the long member at least, these press object 9x cover the perimeter of the buffer mat 3 and two or more press object 9x which can be set to drawing 4 are installed without the abbreviation clearance, they are good also as using these parts. Hereafter, the example of the measuring device which can perform multipoint measurement is explained with reference to drawing 5 thru/or drawing 11 .

[0028] Drawing 5 and drawing 6 show the 1st example of a multipoint measuring device, and the so-called scroll chuck 50 and its so-called driving gear 60 are laid on the level base BS. The chuck pawl 51 movable to coincidence is arranged [in the scroll chuck 50] with equiangular in the radiation direction at three places. According to the rotation drive of the shaft 62 by the motor 61 of a driving gear 60, these chuck pawls 51 are constituted so that only tales doses may move in the radiation direction or the direction of centripetalism. That is, three chuck pawls 51 are constituted by the driving gear 60 possible [closing motion or immobilization in arbitration]. On each chuck pawl 51, installation immobilization of the holder 70 of a L character mold is carried out, and each measuring device DT is constituted. That is, the load cell 80 is being fixed to the upper part of each holder 70, and the long press object 90 is being fixed to the lower part of each load cell 80. In addition, in order to prevent with [of each chuck pawl 51 by the backlash of a scroll chuck 50] backlash, each holder 70 is always energized in the direction of centripetalism, or the radiation direction by the air cylinder 71 fixed on Base BS.

[0029] At the time of measurement, with a driving gear 60, the holder 70 fixed to three chuck pawls 51 and this moves only tales doses in the direction of centripetalism at coincidence, and each press object 90 contacts coincidence to the buffer mat 3 wound around catalyst support 2. When each press object 90 moves to a catalyst support 2-way further, the buffer mat 3 will be pressed from radiation (it is a right angle to the axis of catalyst support 2). The compression reaction force of the buffer

mat 3 in each press section at this time is detected by each (minding each press object 90) load cell 80, and a location (it corresponds to the location SP of distance L from the axis Z shown in drawing 3) when this detection result reaches a predetermined value is detected. And the distance between each press object 90 when arriving at this location and an axis (catalyst support 2) is found, and these averages are calculated.

[0030] In this case, since it can set, for example, the tip location of each press object 90 can be pinpointed based on the rotational frequency of a motor 61, the distance between each press object 90 and an axis (catalyst support 2) can be found. Or with the location measuring device 72 using a digital side length system (for example, trade name by Sony Precision Technology, Inc. "a Magnescale"), as shown in drawing 5 , since the movement magnitude of direct holder 70 grade is detectable, by this example, it is supposed that direct detection of the migration length of each press object 90 will be carried out by this approach.

[0031] Furthermore, installation immobilization of the three supporting structure 40 is carried out at equal intervals between each measuring device DT at the scroll-chuck 50 top. This is equipment which performs auxiliary maintenance during measurement, and it is constituted so that a supporter 42 may be energized in the direction of centripetalism, or the radiation direction by the air cylinder 41, while positioning to the one article 4 of catalyst support 2 and the buffer mat 3 before measurement (centering). It **, each supporting structure 40 moves in the direction of centripetalism in advance of a measurement process, and positioning of elegance 4 is really performed. And the force to the direction of centripetalism is lightly given and held in the condition. Into this maintenance condition, a series of measurement by the measuring device DT is performed, by the air cylinder 41, a supporter 42 drives in the radiation direction, and is isolated from the buffer mat 3, and after measurement termination returns at an initial valve position.

[0032] Suppose that drawing 7 and drawing 8 show the 2nd example of a multipoint measuring device, replace it with the coincidence drive of each measuring device DT in the 1st above-mentioned example, and an individual drive is performed. Between Base BS and each holder 70, the ball screw 74 and the rail 75 are arranged, respectively. If the rotation drive of the ball screw 74 is carried out by each motor 73 fixed on Base BS, it is constituted so that each holder 70 with which each slider 76 (shown in drawing 8) screwed in this drove in the direction of centripetalism or the radiation direction, consequently was fixed to each slider 76 may move in the direction of centripetalism, or the radiation direction. Each measuring device DT is controlled so that only tales doses move to coincidence by the controller (it corresponds to CT of drawing 2), and the same measurement as the 1st example is performed.

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[0033] Drawing 9 and drawing 10 are equipment which shows the 3rd example of a multipoint measuring device and used the centripetalism device of a mechanical arm type. As shown in drawing 9 , within the case 30, two arms 32 are supported to revolve free [rotation] and the head 33 is supported to revolve with the pivot 31 free [rotation] at each tip. And it is equipped with the same press objects 90 and load cells 80 of other as an example at the tip of each head 33. The roller follower 34 is supported to revolve free [rotation] within the case 30 by the other end of each arm 32, and each roller follower 34 contacts the external surface (cam side) of a cam 35, and it is constituted so that each arm 32 may be made to rock by the reaction force. Furthermore, a head 33 is supported to revolve also at the tip of a cam 35 free [rotation], and it is equipped with the press object 90 and the load cell 80 at the tip. And the cam 35 is constituted so that it may drive in the vertical direction of drawing 9 by the air cylinder 36.

[0034] If it ** and a cam 35 drives above drawing 9 by the air cylinder 36, it will rock in the direction in which the tip of two arms 32 approaches mutually with the tip of a cam 35, and three press objects 90 and a load cell 80 will move in the direction of centripetalism. Since the buffer mat 3 is compressed by this after centering of the one article 4 of catalyst support 2 and the buffer mat 3 is carried out to an axis, the same measurement as said example is attained. In addition, drawing 10 shows the condition that the buffer mat 3 is compressed with three press objects 90.

[0035] Although all the contact sides of the press object 90 are formed in the concave bend side, as the example shown in above-mentioned drawing 9 and drawing 10 shows to drawing 11 , a contact side is good also as a press object 91 of a convex surface. In addition, if the area of the part which contacts the buffer mat 3 can be grasped, the configuration of a contact side can be set as arbitration. In addition, although the cylinder in each example was used as the air cylinder, not only this but an oil pressure controller or an electric type etc. is arbitration.

[0036] Next, based on the above-mentioned measurement result, diameter reduction processing or diameter expansion processing is performed to tubed part material, and a process until it considers as a product from the process which forms a part for the attaching part of the buffer mat 3 through the press fit process of the buffer mat 3 and the necking processing process over an edge is explained with reference to drawing 12 and drawing 13 . In addition, although the tubing material slack tubed part material 15 (after processing is called an outer case or housing) for processing is formed with stainless steel tubing with this operation gestalt, it is not limited to this. Moreover, it is good also as forming a tube from a plate at a last process, and cutting established pipe material suitably. Although the board thickness of a tubing material is also arbitrary, as an object for catalytic converters, 1 thru/or about 3mm board

thickness are desirable.

[0037] First, naturally the need bore of the tubed part material 15 is set as a major diameter including the process which drawing 12 performs diameter reduction processing to the tubed part material 15 of a tubing material, and really forms a part for the attaching part of elegance 4 (at least buffer mat 3) rather than the bore after ** et al. and diameter reduction processing mentioned later. At the process (A) of diameter reduction processing, well-known plastic working, such as swaging processing, spinning, and press working of sheet metal, is performed to the tubed part material 15, the overall length for buffer mat 3 attaching part of the center of abbreviation (schedule range) is covered, and it forms in the shape of [which has the diameter reduction section 16 of the substantial radius (L) of the inside for bore controller slack buffer mat 3 attaching part] a hard drum. In this diameter reduction processing, if rodding (mandrel) of a radius L is used if needed, it will be hard coming to generate overshoot and diameter reduction precision will improve. Furthermore, it is good also as forming in the above-mentioned diameter reduction processing and coincidence the annular rib (not shown) projected on the inside or the outside to the diameter reduction section 16 because of the improvement in holding power of shaft orientations.

[0038] An important point is a point that the radius of the inside in the diameter reduction section 16 is L here. That is, it means reproducing as a medium the distance L from the axis Z which shows the radius of the inside for buffer mat 3 attaching part used as the predetermined planar pressure value simulated at the above-mentioned measurement process to drawing 3 by forming the diameter reduction section 16 so that an inside radius may be set to L. In diameter reduction processing, you may constitute so that diameter reduction equipment (not shown) may be automatically controlled using the value of the distance L memorized in Controller CT at the measurement process, and you may constitute so that the value of the distance L displayed by Controller CT may be seen and it may input as desired value of diameter reduction equipment. Or it is good also as doing a diameter reduction activity by the direct operator.

[0039] In addition, with this operation gestalt, since the tubed part material 15 was a cylinder, distance L was made into the inside radius, but when it is an ellipse cross section, also in other cross sections, the distance of an axis and an internal surface should just be set as L that what is necessary is just to set up distance L as a major axis or a minor axis. That is, the radius of the inside for a buffer member attaching part does not mean only the radius of the narrow sense in a cylinder object, and means the radius (distance of an axis and an internal surface) of the wide sense in all cross sections. In addition, although the radius of the distance (L) of a measurement result

and the inside for buffer mat 3 attaching part was made in agreement with this operation gestalt, it is good also as not necessarily not making it completely in agreement, adjusting suitably the radius (distance of an axis and an internal surface) of the inside for buffer mat 3 attaching part, and setting it up within the limits of predetermined, based on the distance (L) of a measurement result. That is, it is good also as taking a desired planar pressure value into consideration, and setting the above-mentioned radius (distance of an axis and an internal surface) over the distance (L) of a measurement result as arbitration by predetermined within the limits.

[0040] Moreover, with this operation gestalt, since collet type shrinker equipment performed diameter reduction processing, it is formed in the shape of a hard drum, but if the diameter reduction section 16 is finally formed, the configuration of the tubing material slack tubed part material 15 will not be asked. Of course, if the taper sections 17 and 18 shown in drawing 12 in this operation gestalt or the openings 23 and 24 of a major diameter are unnecessary, it is good also as reducing the diameter of these, covering an overall length, and carrying out diameter reduction processing. It is important to grasp the radius (distance of an axis and an internal surface) of the inside for buffer mat 3 attaching part itself in any case.

[0041] Next, at a press fit process (B), it presses fit until it really inserts elegance 4 from the opening 23 of the major diameter of the tubed part material 15, or 24 and reaches a predetermined location, but since the taper section 17 formed in the both ends of the diameter reduction section 16 or 18 functions as a press fit guide, it is not necessary to use a press fit fixture like the conventional pressure process, and the fault accompanying use of a press fit fixture is not generated. Of course, it is good also as pressing fit using the conventional press fit fixture, without forming the taper sections 17 and 18. In case elegance 4 is really in a condition since the whole outer diameter is small in the state of compression when the buffer mat 3 is compressed by two or more press object 9x which covered the abbreviation perimeter as shown in drawing 4 in the especially above-mentioned measurement stroke, and were installed and it measures, until it restores to the condition before the compression from this compression condition pressed fit in the tubed part material 15, frictional resistance can press fit that it is few and easily.

[0042] It means that it ** and the condition of, as for after the completion of maintenance of elegance 4, the buffer mat 3 having maintained a design planar pressure value within the diameter reduction section 16, and holding catalyst support 2 was really by the press fit process (B) realized. The fixed numerical width of face to which an actual planar pressure value has a upper limit and a lower limit by tolerance accumulation of a component here There is (it is hereafter called a planar pressure range), for example, it sets to the catalyst support of 2mil900cpsi of super-****. large

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range called 0.05MPa-0.7MPa as a planar pressure range in the former -- not setting up -- it did not obtain, but there was almost no permission margin to the threshold value breakage of catalyst support and whose maintenance become impossible, and the risk on a process was large. On the other hand, since the planar pressure itself is substantially measured in the manufacture approach of this invention, though a planar pressure range is made to zero as for a theory top and a measurement error is expected, a planar pressure range in the same catalyst support as the above can be managed with a setup of very narrow range called 0.2MPa-0.3MPa that what is necessary is just to set up a very narrow planar pressure range.

[0043] thereby, as well as the above-mentioned permission margin increasing, the degree of freedom of a design is also boiled markedly and becomes large. That is, if it is within the limits of 0.05MPa-0.7MPa which is a conventional planar pressure range, since a planar pressure range (0.2MPa-0.3MPa) in the manufacture approach of this invention can be shifted freely, if the improvement in dependability of catalyst support maintenance is aimed at, for example, it is good also as making it shift in the direction of high planar pressure the whole planar pressure range, for example, setting a planar pressure range as 0.3MPa-0.4MPa. In order to realize this, in this invention, the amount of diameter reduction (or the amount of diameter expansion mentioned later) set up based on the value of the distance L of a measurement result is corrected, and, specifically, only the amount of specification should set up small or greatly the above-mentioned radius (distance of an axis and an internal surface) to the value of distance L that what is necessary is to correct to a target planar pressure value and just to set up within the limits of specification.

[0044] Next, in (C), plastic working, such as swaging processing, spinning, and press working of sheet metal, is performed to the both ends obtained at the diameter reduction process (B) a product chemically-modified [which is used as a catalytic-converter product] degree, and the necking sections 20 and 21 are formed in one. In this process (C), if work-piece fixed (roll revolution type) spinning is used, a desired configuration can be acquired efficiently. When forming the necking section of a letter of an inclination like the necking section 21 especially, it is desirable to use the inclination spinning of a publication for the patent reference 4 shown above. Or when forming the eccentricity-like necking section (not shown), it is desirable to use the eccentric spinning of a publication for the patent reference 3 shown above. Since it is processible so that the openings 23 and 24 of a major diameter may disappear at coincidence in the taper section 17 and 18 lists which were formed at the last process (A) if such spinning is used, while processing effectiveness becomes still higher, a configuration degree of freedom also becomes large.

[0045] Including the process which drawing 13 performs diameter expansion

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processing to the tubed part material 15 of a tubing material, and really forms a part for the attaching part of elegance 4 (at least buffer mat 3), although the tubed part material 15 of a tubing material is the same as that of the case of diameter reduction processing of drawing 12 , the need bore of the tubed part material 15 is set as a minor diameter rather than the bore after diameter expansion processing mentioned later. To the tubed part material 15, plastic working, such as expanding processing by the mechanical, the elastic body, fluid pressure, etc. and diameter expansion spinning, is performed, the overall length for buffer mat 3 attaching part of the center of abbreviation (schedule range) is covered, and it fabricates at the process (a) of diameter expansion processing in the configuration which has the bore controller slack diameter expansion section 22, the taper section 19, and the opening 25 of a major diameter. Also in this diameter expansion processing, if an outside restricted mold is used if needed, it will be hard to generate an overshoot problem and diameter expansion precision will improve further.

[0046] The point that the radius of the inside in the diameter expansion section 22 is L is important also here, and the diameter expansion section 22 is formed so that an inside radius may be set to L. Moreover, also in this diameter expansion processing, you may constitute so that diameter expansion equipment (not shown) may be automatically controlled using the value of the distance L memorized in Controller CT at the measurement process, and you may constitute so that the value of the distance L displayed by Controller CT may be seen and it may input as desired value of diameter expansion equipment. Or it is good also as doing a diameter expansion activity by the direct operator. In addition, if the diameter expansion section 22 is formed, the remainder configuration and a whole configuration will not be asked. Also in this operation gestalt, if the taper section 19 and the opening 25 of a major diameter are unnecessary, it is good also as covering an overall length and expanding the diameter uniformly.

[0047] Subsequently, it moves to a press fit process (b), and elegance 4 is really inserted from the opening 25 of a major diameter, and it presses fit until it reaches a predetermined location. Since the taper section 19 functions as a press fit guide also in this case, it is not necessary to use a press fit fixture like the conventional pressure process, and the fault which coils round a press fit fixture is not generated. It means that it **, and the buffer mat 3 maintains a design GBD value, compression pinching is carried out into the diameter expansion section 22 after the completion of maintenance of elegance 4, and the condition that catalyst support 2 was held in design planar pressure was really by the press fit process (b) realized. Then, although (c) is performed a product chemically-modified [which is used as a catalytic-converter product] degree, since this is the same as that of the process (C)

of drawing 12 , explanation is omitted.

[0048] In addition, it is not necessary to necessarily form in one with the tubed part material 15, and they consider as screwing conclusion, and even if desorption is possible for the above-mentioned necking sections 20 and 21, they are good [it is good also as connecting another components by welding etc., and]. Moreover, although above-mentioned diameter reduction processing and above-mentioned diameter expansion processing are an example of a process in the manufacture approach in a catalytic converter, in manufacturing above-mentioned DPF, instead of catalyst support, a filter (not shown) will only be used as a prism and it is almost same at the process itself. Furthermore, an above-mentioned measurement process and an above-mentioned press fit process are good also as necessarily not carrying out continuously and carrying out by differing in time amount and a location. For example, it is really the measurement process was really performed at a certain works good also as pressing elegance 4 fit in the tubed part material 15 at another works.

[0049]

[Effect of the Invention] Since this invention is constituted as mentioned above, it does the effectiveness of a publication so below. That is, in the manufacture approach of the prism supporting structure according to claim 1 to 4, without being influenced by the error of the outer diameter of a prism, the error of the bore of tubed part material, the error of a buffer member, etc., the diameter of the part of tubed part material which holds a buffer member at least can be reduced the diameter of or expanded, and it can adjust to a suitable bore. Especially, finally, a variable will call it only the distance between the axis of a prism, and tubed part material, can surely set up an optimum value, and can reflect this in diameter reduction or diameter expansion of tubed part material. Therefore, the prism supporting structure which held the prism appropriately through the buffer member in tubed part material can be manufactured quickly and easily, and a manufacturing cost can also be reduced.

[0050] Moreover, since according to the manufacture approach of the prism supporting structure according to claim 5 the prism which wound the buffer member can be easily pressed fit in tubed part material in addition to the above-mentioned effectiveness and production time can be shortened sharply, it can manufacture still more quickly and easily.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The manufacture approach concerning 1 operation gestalt of this

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invention is the perspective view showing the buffer mat wound around the target catalyst support and this in a catalytic converter.

[Drawing 2] It is the side elevation showing the measurement process of the manufacture approach concerning 1 operation gestalt of this invention.

[Drawing 3] It is the side elevation showing the measurement condition in the manufacture approach concerning 1 operation gestalt of this invention.

[Drawing 4] It is the perspective view showing another example of the measurement process of the manufacture approach concerning 1 operation gestalt of this invention.

[Drawing 5] It is the top view showing the 1st example of the multipoint measuring device with which the measurement process of the manufacture approach concerning 1 operation gestalt of this invention is presented.

[Drawing 6] It is the front view showing the 1st example of the multipoint measuring device with which the measurement process of the manufacture approach concerning 1 operation gestalt of this invention is presented.

[Drawing 7] It is the top view showing the 2nd example of the multipoint measuring device with which the measurement process of the manufacture approach concerning 1 operation gestalt of this invention is presented.

[Drawing 8] It is the front view showing the 2nd example of the multipoint measuring device with which the measurement process of the manufacture approach concerning 1 operation gestalt of this invention is presented.

[Drawing 9] It is the top view showing the 3rd example of the multipoint measuring device with which the measurement process of the manufacture approach concerning 1 operation gestalt of this invention is presented.

[Drawing 10] It is the top view showing some [in the 3rd example of the multipoint measuring device with which the measurement process of the manufacture approach concerning 1 operation gestalt of this invention is presented] operating states.

[Drawing 11] It is the top view showing another example of the press object in the 3rd example of the multipoint measuring device with which the measurement process of the manufacture approach concerning 1 operation gestalt of this invention is presented.

[Drawing 12] the diameter reduction process in the manufacture approach concerning 1 operation gestalt of this invention, a press fit process, and product chemically-modified degree is shown -- it is a sectional view a part.

[Drawing 13] the diameter expansion process in the manufacture approach concerning other operation gestalten of this invention, a press fit process, and product chemically-modified degree is shown -- it is a sectional view a part.

[Description of Notations]

2 Catalyst Support 3 Buffer Mat 4 One Article DT Measuring Device, 5 Clamp

Equipment 8 Load Cell 9 Press Object, 10 Actuator 12 Rotary Encoder, 16 Diameter Reduction Section 22 Diameter Expansion Sections

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[Translation done.]

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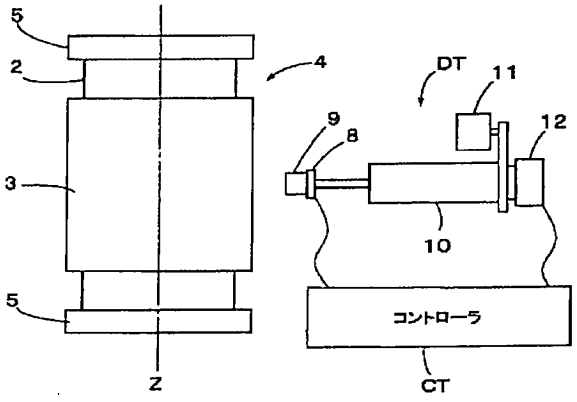
(54)【発明の名称】　柱体保持装置の製造方法

(57)【要約】
【課題】　筒状部材の少なくとも緩衝部材を保持する部分の内径を適切に調整し、この筒状部材内に、緩衝部材を巻回した柱体を圧入して適切に保持する。
【解決手段】　柱体（触媒担体２）の外周に緩衝部材（緩衝マット３）を巻回した状態で、押圧体９によって柱体の軸芯に対して直交する方向に緩衝部材を押圧して緩衝部材を圧縮すると共に、柱体に対する緩衝部材の面圧を検出し、この面圧が所定の値となるときの柱体の軸芯と押圧体の先端との間の所定距離を測定する。そして、緩衝部材を巻回した柱体を、少なくとも緩衝部材を保持する部分の内側の実質的な半径が所定距離となるように予め縮径又は拡径した筒状部材に対し、緩衝部材を柱体の外周に巻回した状態で、圧入する。



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【特許請求の範囲】

【請求項１】　筒状部材内に緩衝部材を介して柱体を保持する柱体保持装置の製造方法において、前記柱体の外周に前記緩衝部材を巻回した状態で、押圧体によって前記柱体の軸芯に対して直交する方向に前記緩衝部材を押圧して前記緩衝部材を圧縮すると共に、前記柱体に対する前記緩衝部材の面圧を検出し、該面圧が所定の値となるときの前記柱体の軸芯と前記押圧体の先端との間の所定距離を測定し、前記緩衝部材を巻回した前記柱体を、少なくとも前記緩衝部材を保持する部分の内側の実質的な半径が前記所定距離となるように予め縮径又は拡径した前記筒状部材に対し、前記緩衝部材を前記柱体の外周に巻回した状態で、圧入することを特徴とする柱体保持装置の製造方法。

【請求項２】　前記所定の値は、前記柱体の外面の静摩擦係数及び前記筒状部材の内面の静摩擦係数と、前記押圧体の前記緩衝部材に対する押圧力に基づいて設定することを特徴とする請求項１記載の柱体保持装置の製造方法。

【請求項３】　前記押圧体を前記緩衝部材の全周に亘って複数個並設し、該複数個の押圧体の少なくとも一つによって前記柱体の軸芯に対して直交する方向に前記緩衝部材を押圧して前記緩衝部材を圧縮すると共に、前記柱体に対する前記緩衝部材の面圧を検出することを特徴とする請求項１記載の柱体保持装置の製造方法。

【請求項４】　前記複数個の押圧体は、前記筒状部材の少なくとも前記緩衝部材を保持する部分に相当する長さの長尺部材で構成すると共に、該長尺部材の押圧体を前記緩衝部材の全周に亘って並設して成ることを特徴とする請求項３記載の柱体保持装置の製造方法。

【請求項５】　前記面圧が所定の値となるときの圧縮状態から圧縮前の状態に復元するまでの状態にある前記緩衝部材を巻回して成る前記柱体を、前記筒状部材に圧入することを特徴とする請求項４に記載の柱体保持装置の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、筒状部材内に緩衝部材を介して柱体を保持する柱体保持装置の製造方法に関し、例えば、筒状部材内に緩衝マットを介して柱体の触媒担体を保持する触媒コンバータの製造方法として好適な製造方法に係る。

【０００２】

【従来の技術】流体に対してフィルタ機能を有するハニカム構造の柱体を、金属製筒状部材内に緩衝部材を介して保持する柱体保持装置が流体処理装置として用いられ、種々の流体の浄化に供されている。例えば、自動車の排気系においては触媒コンバータやディーゼルパティキュレートフィルタ（以下、ＤＰＦという）が搭載されており、触媒担体あるいはフィルタ等（総称して担体と

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いい、以下、触媒担体いうときはこれらを代表する）としてセラミック製の脆弱なハニカム構造の柱体が用いられている。このハニカム構造の柱体はセラミックマット等の緩衝部材を介して金属製筒状部材内に保持されて流体処理装置が構成され、その一例として触媒コンバータがある。そして、この触媒コンバータのような柱体保持装置の製造方法としては、触媒担体の外周に緩衝部材を巻回し、この緩衝部材を圧縮しながら筒状部材内に収容する圧入による製造方法が一般的である。

【０００３】例えば、下記の特許文献１（特開２００１－３５５４３８）には、外周に保持材が装着された触媒担体を保持筒に圧入するに際し、触媒担体の外径を計測し、この計測値に適合する内径を有する保持筒に保持材が装着された触媒担体を圧入する触媒コンバータの製造方法が提案されている。また、触媒担体の外周に装着された保持材の外径を計測し、この計測値に適合する内径を有する保持筒に保持材が装着された触媒担体を圧入する方法も提案されている。更に、保持材の外径を計測するに際し、所定の圧力を加えた状態で計測することも提案されている。そして、同特許文献１においては、内径が異なる多数の保持筒の素材を予め準備しておき、その中から適正な内径を有するものを選択することが提案されている。

【０００４】尚、特許文献１において従来技術として引用された下記の特許文献２には、スピニングによる縮径加工が開示されている。更に、圧入後の筒状部材の端部に対するネッキング加工として、下記の特許文献３に偏芯スピニング加工が開示され、下記の特許文献４に傾斜スピニング加工が開示されている。

【０００５】

【特許文献１】特開２００１－３５５４３８号公報

【特許文献２】特開２０００－４５７６２号公報

【特許文献３】特許第２９５７１５３号公報

【特許文献４】特許第２９５７１５４号公報

【０００６】

【発明が解決しようとする課題】前掲の特許文献１には、「触媒担体２を保持筒１に圧入したときに保持材３に加わる圧力（以下、保持圧という。）と同等の圧力を保持材３に作用させた状態で保持材３の外径を計測するのが望ましい」と記載されているが、このような圧入方法において、後工程で保持材に加えられる圧力を推定することは不可能であり、この点に関する説明も見あたらない。即ち、触媒担体２を保持筒１に圧入したときに保持材３に加わる圧力と同等の圧力を保持材３に作用させた状態とする旨の記載は願望の域を脱しておらず、ほかに実現可能と解し得る開示は見あたらない。

【０００７】更に、前掲の特許文献１には、「保持筒１の素材としては、圧入後の保持材３に触媒担体２に適正な圧力を作用させることができるような内径を有するものが用いられる。これは、内径が異なる多数の素材を予

め準備しておき、その中から適正な内径を有するものを選択することによって達成することができる」旨記載されていることに鑑みると、圧入したときに保持材３に加わる圧力と同等の圧力を保持材３に作用させた状態で保持材３の外径を計測（これは上記のように不可能であるが、仮に可能であるとして）した結果に応じて、保持筒１の内径を調整するものでもないことは明らかである。結局、どのように圧力を作用させた状態で保持材３の外径を計測し、どのような計測結果をどのように利用しているかについては定かではない。

【０００８】これに対し、従前の圧入による製造方法においては、一般的に、緩衝部材たる緩衝マットの充填密度（ＧＢＤ値と呼ばれる）を基準に触媒担体の外径と筒状部材の内径との間隙が設定される。このＧＢＤ値は、単位面積当り重量／充填間隙寸法であり、緩衝マットの充填密度に応じて面圧（単位：パスカル）が発生し、この面圧によって触媒担体が保持されるのであるが、面圧は、当然乍ら触媒担体の強度を超えない値に調整すると共に、振動や排気ガス圧力が加わる触媒担体に対し、これが筒状部材内を移動しないように保持し得る値に調整しなければならない。このためには、緩衝部材は設計範囲内のＧＢＤ値で圧入され、且つこのＧＢＤ値を製品のライフサイクルの間は維持しなければならない。

【０００９】しかし、上記の一般的な圧入による製造方法においては、製造上必然的に生ずる触媒担体の外径の誤差、筒状部材の内径の誤差、及びこれらの間に介装される緩衝部材（緩衝マット）の単位面積当り重量の誤差が重畳されてＧＢＤ値の誤差となる。従って、このＧＢＤ値の誤差を最小とするための各部材の最適組合せを見い出すことは、量産のための現実的な解決とはなりえない。また、ＧＢＤ値自体も、緩衝部材の特性や個体差に左右され、しかも平面上における測定値に依拠しており、触媒担体に対し緊密に巻回された状態における測定値を表すものではない。このため、従来のようにＧＢＤ値に依存することなく、触媒担体を適切に筒状部材内に圧入することが望まれている。

【００１０】ここで、触媒担体を筒状部材内の所定位置に保持するために必要とされる保持力について説明すると、筒状部材の径方向の保持力は、触媒担体の外面及び筒状部材の内面に対し直交する方向に働く緩衝部材の圧縮復元力である。一方、例えば自動車の排気装置に固定された筒状部材に対し、触媒担体及び緩衝部材には振動や排気ガス圧力によって軸方向の力が生ずるので、これに抗する力として筒状部材の軸方向（長手方向）の保持力が必要であり、これは緩衝部材と触媒担体との間の摩擦力、及び緩衝部材と筒状部材との間の摩擦力が資するところとなる。

【００１１】上記の緩衝部材と触媒担体との間の摩擦力、及び緩衝部材と筒状部材との間の摩擦力は夫々、触媒担体の外面と緩衝部材との間の静摩擦係数を緩衝部材

の圧縮復元力（面圧）に乗じた積、及び筒状部材の内面と緩衝部材との間の静摩擦係数を緩衝部材の圧縮復元力（面圧）に乗じた積として表される。このとき、軸方向（長手方向）の保持力としては、静摩擦係数が低い方の部材と緩衝部材との間の摩擦力が支配的となる。従って、静摩擦係数が判明している触媒担体及び筒状部材に関し、必要な摩擦力が明らかとなり、これを確保するためには緩衝部材に対する面圧を高くする必要があるが、触媒担体が脆弱な場合は径方向の荷重が過大となることを回避するためには、緩衝部材に対する面圧の限度内で、軸方向の保持力を確保し得るように設定する必要がある。

【００１２】而して、緩衝部材に対する面圧は、触媒担体の外面の静摩擦係数と筒状部材の内面の静摩擦係数のうちの低い方の部材の静摩擦係数に基づいて設定し、その面圧に応じて、筒状部材の少なくとも緩衝部材保持部分の内径を設定すればよい。即ち、筒状部材内に緩衝部材を介して触媒担体を保持するに際し、最も適切な制御パラメータは、緩衝部材（緩衝マット）を介して触媒担体に付与される面圧（単位：パスカル）であり、この面圧を直接検出し、あるいはこれに一義的に対応する値もしくは近似した値を検出し、その検出結果に基づいて、圧入すべき筒状部材の少なくとも緩衝部材保持部分の内径を設定することが望ましい。

【００１３】しかし、従来方法においては、前述のＧＢＤ値に基づく管理が一般的であり、いわば代用値による推定管理が行なわれているということになる。このため、推定要因が重畳されて誤差が不可避となるというだけでなく、結果的に、緩衝部材と触媒担体との間の摩擦力による保持力と、緩衝部材と筒状部材との間の摩擦力による保持力が混同されて、各部品の寸法関係が設定されている。また、前掲の特許文献１における計測においても必然的に、後工程に対する推定要因が重畳されて誤差が生ずることから、何らかの対策を講ずる必要がある。

【００１４】そこで、本発明は、筒状部材内に緩衝部材を介して柱体を保持する柱体保持装置の製造方法において、筒状部材の少なくとも緩衝部材を保持する部分の内径を適切に調整し、この筒状部材内に、緩衝部材を巻回した柱体を圧入して適切に保持し得るようにすることを課題とする。

【００１５】

【課題を解決するための手段】上記課題を解決するため、本発明は、請求項１に記載のように、筒状部材内に緩衝部材を介して柱体を保持する柱体保持装置の製造方法において、前記柱体の外周に前記緩衝部材を巻回した状態で、押圧体によって前記柱体の軸芯に対して直交する方向に前記緩衝部材を押圧して前記緩衝部材を圧縮すると共に、前記柱体に対する前記緩衝部材の面圧を検出し、該面圧が所定の値となるときの前記柱体の軸芯と前

記押圧体の先端との間の所定距離を測定し、前記緩衝部材を巻回した前記柱体を、少なくとも前記緩衝部材を保持する部分の内側の実質的な半径が前記所定距離となるように予め縮径又は拡径した前記筒状部材に対し、前記緩衝部材を前記柱体の外周に巻回した状態で、圧入することとしたものである。

【００１６】上記の柱体保持装置の製造方法において、請求項２に記載のように、前記所定の値は、前記柱体の外面の静摩擦係数及び前記筒状部材の内面の静摩擦係数と、前記押圧体の前記緩衝部材に対する押圧力に基づいて設定するように構成するとよい。

【００１７】上記の柱体保持装置の製造方法において、請求項３に記載のように、前記押圧体を前記緩衝部材の全周に亘って複数個並設し、該複数個の押圧体の少なくとも一つによって前記柱体の軸芯に対して直交する方向に前記緩衝部材を押圧して前記緩衝部材を圧縮すると共に、前記柱体に対する前記緩衝部材の面圧を検出するように構成するとよい。更に、前記複数個の押圧体は、請求項４に記載のように、前記筒状部材の少なくとも前記緩衝部材を保持する部分に相当する長さの長尺部材で構成すると共に、該長尺部材の押圧体を前記緩衝部材の全周に亘って並設するとよい。

【００１８】上記請求項４に記載の柱体保持装置の製造方法において、請求項５に記載のように、前記面圧が所定の値となるときの圧縮状態から圧縮前の状態に復元するまでの状態にある前記緩衝部材を巻回して成る前記柱体を、前記筒状部材に圧入することとしてもよい。これにより、前記緩衝部材を巻回して成る前記柱体を、前記筒状部材内に圧入した後に、前記緩衝部材が完全に復元し初期の圧縮状態となるので、容易に圧入することができる。尚、前記緩衝部材が圧縮前の状態に復元した後に、前記筒状部材内に圧入する場合にも、前記筒状部材は、少なくとも前記緩衝部材を保持する部分の内側の実質的な半径が前記所定距離となるように予め縮径又は拡径されたものであるので、過大に圧縮されることなく適切に圧入される。

【００１９】

【発明の実施の形態】上記の筒状部材内に緩衝部材を介して柱体を保持する柱体保持装置の製造方法に関し、その具体的一態様として、触媒コンバータの製造方法について図面を参照して説明する。先ず、図１に示すように、本発明の柱体を構成する触媒担体２の外周に、本発明の緩衝部材を構成する緩衝マット３を一層巻回し、必要に応じ可燃性テープ等によって固定する。これによって、図１の一体品４が構成される。この場合において、緩衝マット３の両端には図１に示すように凸部と凹部を形成しておき、これらが相互に嵌合する一般的な巻回方法を用いるとよい。

【００２０】本実施形態においては、触媒担体２はセラミックス製ハニカム構造の柱体で構成されているが、金属製でもよく、材質、製法は問わない。緩衝マット３は、本実施形態では熱による膨張が殆どないアルミナマットで構成されているが、熱膨張型のバーミキュライト式の緩衝マットや、それらを組み合わせた緩衝マットとしてもよい。また、バインダーが含浸されていない無機質繊維マットでもよい。尚、バインダーの有無及び含有量によって面圧が変わるので、後述の面圧設定においてはこれを加味する必要がある。あるいは、金属細線を編成したワイヤメッシュ等を用いてもよいし、それをセラミックマットと組み合わせて使用してもよい。更に、それらと金属円環状のリテーナや、ワイヤメッシュ製のシールリング等と組み合わせてもよい。

【００２１】次に、図２に示すように、上記の一体品４を一対のクランプ装置５間に把持し、測定装置ＤＴの押圧体９によって、緩衝マット３を介して触媒担体２をその軸芯Ｚに対して直交する方向に押圧すると共に、触媒担体２に付与される面圧を検出し、該面圧が所定の値となるときの、触媒担体２の軸芯Ｚと押圧体９との間の距離Ｌを測定する。そして、測定後、押圧体９を原位置に復帰させた後、クランプ装置５による把持を解除する。尚、この測定行程において、触媒担体２及び緩衝マット３自体の寸法及び特性値を測定する必要はない。以下、本実施形態で用いるクランプ装置５及び測定装置ＤＴについて説明する。

【００２２】クランプ装置５は、例えばコレットチャックで構成され、これによって触媒担体２の上下端部が挟持されてその軸芯Ｚが所定の測定位置にセットされる。本実施形態の測定装置ＤＴは、モータ１１駆動のボールスクリュー式アクチュエータ１０と、その先端にロードセル８を介して支持された押圧体９と、後端に配置された位置検出手段たるロータリエンコーダ１２を備えている。ロードセル８及びロータリエンコーダ１２の検出信号は電子制御装置（以下、コントローラという）ＣＴに入力され、後述の各種データに変換されてメモリ（図示せず）に記憶されると共に、モータ１１はコントローラＣＴによって駆動制御されるように構成されている。

【００２３】押圧体９は触媒担体２の軸芯Ｚに対して直交する方向（図２の左右方向）に進退し、緩衝マット３に当接後これを圧縮し得るように配置される。押圧体９の当接面積は既知であるので、この押圧体９によって測定対象たる触媒担体２及び緩衝マット３が押圧されたときの反力が、触媒担体２に対する面圧としてロードセル８によって検出され、コントローラＣＴに入力される。コントローラＣＴにおいては、ロードセル８の検出信号が面圧値に換算されてメモリに記憶され、別途予め入力された所定の面圧値と比較される。また、ロータリエンコーダ１２によって押圧体９の進退量及び停止位置がボールスクリュー（図示せず）の回転情報として検出され、コントローラＣＴに入力される。コントローラＣＴにおいては、ロータリエンコーダ１２の検出信号がリア

ルタイムで押圧体９の進退量及び停止位置の値に変換されてメモリに記憶される。尚、これらの検出手段とコントローラＣＴとの間は電気的に接続してもよいし光学的に接続してもよい。

【００２４】上記のように構成された測定装置ＤＴを以下のように駆動することによって、触媒担体２の軸芯Ｚと押圧体９との間の距離と、そのときに触媒担体２に付与される面圧との関係を測定することができる。即ち、押圧体９を初期位置から前進（図２の左方向に移動）させて緩衝マット３の一部を押圧し、図３に示すように、押圧部における緩衝マット３の圧縮反力をロードセル８によって検出し、この検出結果が所定の値に到達したときの位置（図３に示す軸芯Ｚから距離Ｌの位置ＳＰ）を検出する。この位置（軸芯Ｚから距離Ｌの位置）は、製品となった後の緩衝マット３の面圧が所定の値となるときの、後述する筒状部材の（縮径加工後の）緩衝マット３保持部分の内壁面の位置に相当する。従って、触媒担体２に付与される押圧力とそれによって生ずる反力（面圧）との関係を、予めコントローラＣＴのメモリに記憶しておき、この関係に基づきロードセル８の検出信号（反力）を面圧値に変換し、これと所定の面圧値とを比較しながら押圧体９を上記の位置（軸芯Ｚから距離Ｌの位置）まで前進させ、押圧体９の移動距離を求める。

【００２５】而して、押圧体９の先端の初期位置と触媒担体２の軸芯Ｚとの間の所定距離から、ロータリエンコーダ１２によって検出される押圧体９の移動距離を差し引けば押圧体９の先端の位置（即ち、軸芯Ｚからの距離Ｌ）を判定することができ、この位置が、製品状態（即ち、後述する筒状部材内で触媒担体２に対する面圧が所定の面圧値で保持されている状態）における、筒状部材の（縮径加工後の）緩衝マット３保持部分の内壁面の位置ということになる。このように、本実施形態によれば触媒担体２及び緩衝マット３の寸法や特性値を個別に測定することなく、また前述のＧＢＤ値を用いることなく、所定の面圧値となる位置（図３に示す軸芯Ｚから距離Ｌの位置ＳＰ）を判定することができる。即ち、上記の触媒担体２の軸芯Ｚと押圧体９の先端との間の距離Ｌは、結果的に触媒担体２の外径誤差のみならず緩衝マット３の単位面積当り重量の誤差をも考慮した値となるので、これらの誤差を別途測定する必要はない。

【００２６】尚、上記の距離Ｌは、次工程に備え、コントローラＣＴのメモリに記憶されるが、必要に応じて表示するように構成してもよい。また、押圧体９は、必ずしも所定の位置（図３に示す軸芯Ｚから距離Ｌの位置）で停止させる必要はなく、この位置を検出後そのまま連続して後退させ、更に、この押圧体９の後退に同期してクランプ装置５による把持を解除させるように構成してもよい。

【００２７】更に、図４に示すように、触媒担体２の軸芯Ｚの回りに放射状に複数の押圧体９ｘを配置し、これらを含む複数の測定装置ＤＴによる多点測定を行ない、あるいは、軸芯Ｚの回りにクランプ装置５及び一体品４を回動（割り出し）させて多点測定を行なうように構成し、各測定値の平均を求めることとしてもよい。特に、触媒担体２が円形断面でない場合には、触媒担体２の形状に応じて多点測定を行なう必要があるので、複数の測定装置ＤＴを配置することが望ましい。尚、図４における複数の押圧体９ｘは、少なくとも緩衝マット３の軸方向長さより長尺の部材で構成され、これらの押圧体９ｘが緩衝マット３の全周に亘って、略隙間無く並設されているが、これらの一部を用いることとしてもよい。以下、多点測定を行ない得る測定装置の実施例について、図５乃至図１１を参照して説明する。

【００２８】図５及び図６は多点測定装置の第１実施例を示すもので、水平なベースＢＳ上に所謂スクロールチャック５０とその駆動装置６０が載置されている。スクロールチャック５０には、放射方向に同時に移動可能なチャック爪５１が等角度で三箇所に配置されている。これらのチャック爪５１は、駆動装置６０のモータ６１によるシャフト６２の回転駆動に応じて、同量だけ放射方向又は求心方向へ移動するように構成されている。即ち、駆動装置６０によって、三つのチャック爪５１が任意に開閉又は固定可能に構成されている。各チャック爪５１上には、Ｌ字型のホルダ７０が載置固定され、各測定装置ＤＴが構成されている。即ち、各ホルダ７０の上部にはロードセル８０が固定されており、各ロードセル８０の下部には長尺の押圧体９０が固定されている。尚、スクロールチャック５０のバックラッシュによる各チャック爪５１のガタつきを防止するため、各ホルダ７０は、ベースＢＳ上に固定されたエアシリンダ７１によって、常に求心方向あるいは放射方向に付勢されている。

【００２９】測定時には、駆動装置６０によって、三つのチャック爪５１及びこれに固定されたホルダ７０が同時に同量だけ求心方向へ移動し、触媒担体２に巻回された緩衝マット３に対し各押圧体９０が同時に当接する。各押圧体９０が更に触媒担体２方向に移動すると、緩衝マット３を放射方向から（触媒担体２の軸芯に対し直角方向から）押圧することになる。このときの各押圧部における緩衝マット３の圧縮反力を（各押圧体９０を介して）各ロードセル８０にて検出し、この検出結果が所定の値に到達したときの位置（図３に示す軸芯Ｚから距離Ｌの位置ＳＰに対応）を検出する。そして、この位置に達したときの各押圧体９０と（触媒担体２の）軸芯との間の距離を求め、これらの平均値を求める。

【００３０】この場合において、例えばモータ６１の回転数に基づき各押圧体９０の先端位置を特定することができるので、各押圧体９０と（触媒担体２の）軸芯との間の距離を求めることができる。あるいは、図５に示すように、デジタル側長システム（例えば、ソニープレシ

ジョンテクノロジー株式会社製の商品名「マグネスケール」）を用いた位置測定装置７２により、直接ホルダ７０等の移動量を検出することができるので、本実施例ではこの方法によって各押圧体９０の移動距離を直接検出することとしている。

【００３１】更に、スクロールチャック５０上には、各測定装置ＤＴの間に等間隔で三つの保持装置４０が載置固定されている。これは、測定前に触媒担体２及び緩衝マット３の一体品４に対し位置決め（センタリング）を行なうと共に、測定中に補助的な保持を行なう装置で、エアシリンダ４１によって保持体４２を求心方向又は放射方向に付勢するように構成されている。而して、測定工程に先立ち、各保持装置４０が求心方向へ移動して一体品４の位置決めが行なわれる。そして、その状態で軽く求心方向への力が付与されて保持される。この保持状態中に、測定装置ＤＴによる一連の測定が行なわれ、測定終了後はエアシリンダ４１によって保持体４２が放射方向に駆動されて緩衝マット３から離隔し、初期位置に戻る。

【００３２】図７及び図８は多点測定装置の第２実施例を示すもので、上記の第１実施例における各測定装置ＤＴの同時駆動に代えて、個別駆動を行なうこととしたものである。ベースＢＳと各ホルダ７０との間には、夫々ボールスクリュー７４及びレール７５が配置されている。ベースＢＳ上に固定された各モータ７３によってボールスクリュー７４が回転駆動されると、これに螺合する各スライダ７６（図８に示す）が求心方向又は放射方向へ駆動され、この結果、各スライダ７６に固定された各ホルダ７０が求心方向又は放射方向へ移動するように構成されている。各測定装置ＤＴはコントローラ（図２のＣＴに対応）により同時に同量だけ移動するように制御され、第１実施例と同様の測定が行なわれる。

【００３３】図９及び図１０は多点測定装置の第３実施例を示すもので、メカニカルなアーム式の求心機構を利用した装置である。図９に示すように、ケース３０内でピボット３１にて二つのアーム３２が回動自在に軸支され、夫々の先端にヘッド３３が回動自在に軸支されている。そして、各ヘッド３３の先端には、他の実施例と同様の押圧体９０及びロードセル８０が装着されている。各アーム３２の他端には、ローラフォロア３４がケース３０内で回転自在に軸支されており、各ローラフォロア３４はカム３５の外面（カム面）に当接し、その反力で各アーム３２を揺動させるように構成されている。更に、カム３５の先端にも、ヘッド３３が回動自在に軸支され、その先端に押圧体９０及びロードセル８０が装着されている。そして、カム３５は、エアシリンダ３６によって図９の上下方向に駆動されるように構成されている。

【００３４】而して、カム３５がエアシリンダ３６によって図９の上方に駆動されると、カム３５の先端と共に二つのアーム３２の先端が相互に近接する方向に揺動し、三つの押圧体９０及びロードセル８０は求心方向へ移動する。これにより、触媒担体２及び緩衝マット３の一体品４が軸芯にセンタリングされた後に緩衝マット３が圧縮されるので、前記実施例と同様の測定が可能となる。尚、図１０は、三つの押圧体９０によって緩衝マット３が圧縮されている状態を示す。

【００３５】上記図９および図１０に示す実施例では、押圧体９０の当接面は全て凹曲面に形成されているが、図１１に示すように当接面が凸曲面の押圧体９１としてもよい。このほか、緩衝マット３に当接する部分の面積が把握できれば、当接面の形状は任意に設定することができる。尚、各実施例におけるシリンダはエアシリンダとしたが、これに限らず、油圧式あるいは電気式等任意である。

【００３６】次に、上記の測定結果に基づき、筒状部材に対し縮径加工又は拡径加工を行い、緩衝マット３の保持部分を形成する工程から、緩衝マット３の圧入工程、及び端部に対するネッキング加工工程を経て製品とするまでの工程について図１２及び図１３を参照して説明する。尚、加工対象の管素材たる筒状部材１５（加工後は外筒あるいはハウジングと呼ばれる）は、本実施形態ではステンレススチール管で形成されているが、これに限定するものではない。また、適宜、前工程にて板材から造管してもよく、既成のパイプ材を切断することとしてもよい。管素材の板厚も任意であるが、触媒コンバータ用としては、１乃至３ｍｍ程度の板厚が望ましい。

【００３７】先ず、図１２は、管素材の筒状部材１５に対し縮径加工を行なって一体品４（少なくとも緩衝マット３）の保持部分を形成する工程を含むもので、筒状部材１５の必要内径は、当然乍ら、後述する縮径加工後の内径よりも大径に設定される。縮径加工の工程（Ａ）では、筒状部材１５に対してスエージング加工、スピニング加工、プレス加工等公知の塑性加工を行い、略中央の緩衝マット３保持部分（予定範囲）の全長に亘って、内径調整部たる緩衝マット３保持部分の内側の実質的な半径（Ｌ）の縮径部１６を有する鼓状に形成する。この縮径加工においては、必要に応じて半径Ｌの芯金（マンドレル）を用いれば、オーバーシュートが発生し難くなり、縮径精度が向上する。更に、軸方向の保持力向上のため、上記の縮径加工と同時に、縮径部１６に対し、内側あるいは外側に突出した環状リブ（図示せず）を形成することとしてもよい。

【００３８】ここで重要な点は、縮径部１６における内側の半径がＬであるという点である。即ち、内側の半径がＬとなるように縮径部１６を形成することにより、前述の測定工程でシミュレートした所定の面圧値となる緩衝マット３保持部分の内側の半径を、図３に示す軸芯Ｚからの距離Ｌを媒介として再現したことになる。縮径加工においては、測定工程にてコントローラＣＴ内に記憶

された距離Ｌの値を用いて自動的に縮径装置（図示せず）を制御するように構成してもよいし、コントローラＣＴによって表示された距離Ｌの値を見て縮径装置の目標値として入力するように構成してもよい。あるいは、直接作業者によって縮径作業を行なうこととしてもよい。

【００３９】尚、本実施形態では筒状部材１５が円筒であるため距離Ｌを内側の半径としたが、楕円断面である場合には距離Ｌは長径又は短径として設定すればよく、その他の断面の場合も軸芯と内壁面との距離をＬに設定すればよい。即ち、緩衝部材保持部分の内側の半径は、円筒体における狭義の半径のみを意味するものではなく、あらゆる断面における広義の半径（軸芯と内壁面との距離）を意味する。尚、本実施形態では測定結果の距離（Ｌ）と緩衝マット３保持部分の内側の半径を一致させたが、必ずしも完全に一致させる必要はなく、測定結果の距離（Ｌ）に基づき所定の範囲内で緩衝マット３保持部分の内側の半径（軸芯と内壁面との距離）を適宜調整して設定することとしてもよい。即ち、所望の面圧値を勘案して、測定結果の距離（Ｌ）に対する上記の半径（軸芯と内壁面との距離）を所定範囲内で任意に設定することとしてもよい。

【００４０】また、本実施形態ではコレット式シュリンカー装置によって縮径加工を行なったため、鼓状に形成されているが、最終的に縮径部１６が形成されるのであれば、管素材たる筒状部材１５の形状は問わない。もちろん本実施形態において、図１２に示すテーパ部１７及び１８あるいは大径の開口部２３及び２４が不要であれば、これらを縮径してもよく、全長に亘って縮径加工することとしてもよい。何れの場合にも、緩衝マット３保持部分の内側の半径（軸芯と内壁面との距離）そのものを把握することが肝要である。

【００４１】次に、圧入工程（Ｂ）では、筒状部材１５の大径の開口部２３又は２４から一体品４を挿入し、所定位置に至るまで圧入するのであるが、縮径部１６の両端に形成されたテーパ部１７又は１８が圧入ガイドとして機能するため、従来の圧入法のような圧入治具を用いる必要がなく、圧入治具の利用に伴う不具合は発生しない。もちろん、テーパ部１７及び１８を形成することなく従来の圧入治具を用いて圧入することとしてもよい。特に、前述の測定行程において、図４に示すような略全周に亘って並設した複数の押圧体９ｘによって緩衝マット３を圧縮して測定した場合には、圧縮状態では全体の外径が小さくなっているので、この圧縮状態から圧縮前の状態に復元するまでの状態にある一体品４を筒状部材１５に圧入する際に、摩擦抵抗が少なく容易に圧入することができる。

【００４２】而して、圧入工程（Ｂ）による一体品４の保持完了後は、縮径部１６内で緩衝マット３が設計面圧値を保って触媒担体２を保持する状態が実現されたこととなる。ここで、実際の面圧値は、構成品の公差累積により上限値と下限値を有する一定の数値幅（以下、面圧レンジという）があり、例えば、超薄壁の２ｍｉ１９００ｃｐｓｉの触媒担体においては、従来は面圧レンジとして０．０５ＭＰａ～０．７ＭＰａという広い範囲を設定せざるを得ず、触媒担体の破損や保持不可能となる限界値に対して、許容マージンが殆どなく、工程上のリスクが大きかった。これに対し、本発明の製造方法においては実質的に面圧そのものを測定しているので、理論上は面圧レンジをゼロにでき、測定誤差を見込むとしても、極めて狭い面圧レンジを設定すればよく、上記と同じ触媒担体における面圧レンジは例えば０．２ＭＰａ～０．３ＭＰａという極めて狭い範囲の設定で済むことになる。

【００４３】これにより、上記の許容マージンが増加することはもちろん、設計の自由度も格段に大きくなる。つまり、従来の面圧レンジである０．０５ＭＰａ～０．７ＭＰａの範囲内であれば、本発明の製造方法における面圧レンジ（０．２ＭＰａ～０．３ＭＰａ）を自由にシフトさせることができるので、例えば触媒担体保持の信頼性向上を狙うのであれば、面圧レンジごと高面圧方向にシフトさせて、例えば面圧レンジを０．３ＭＰａ～０．４ＭＰａに設定することとしてもよい。これを実現するためには、本発明においては、測定結果の距離Ｌの値を基に設定する縮径量（あるいは、後述する拡径量）を修正して、特定の範囲内で目標とする面圧値に修正して設定すればよく、具体的には、上記の半径（軸芯と内壁面との距離）を距離Ｌの値に対して特定量だけ小さく、あるいは大きく設定すればよい。

【００４４】次に、触媒コンバータ製品とする製品化工程（Ｃ）においては、縮径工程（Ｂ）にて得られた両端部に対し、スエージング加工、スピニング加工、プレス加工等の塑性加工を行い、ネッキング部２０及び２１を一体的に形成する。この工程（Ｃ）においては、ワーク固定式（ロール公転式）のスピニング加工を用いれば、効率よく所望の形状を得ることができる。特に、ネッキング部２１のような傾斜状のネッキング部を形成する場合には、前掲の特許文献４に記載の傾斜スピニング加工を用いることが望ましい。あるいは、偏芯状のネッキング部（図示せず）を形成する場合には、前掲の特許文献３に記載の偏芯スピニング加工を用いることが望ましい。このようなスピニング加工を用いれば、前工程（Ａ）で形成されたテーパ部１７及び１８並びに大径の開口部２３及び２４が同時に消失するように加工することができるので、加工効率が一層高くなると共に、形状自由度も大きくなる。

【００４５】図１３は、管素材の筒状部材１５に対し拡径加工を行なって一体品４（少なくとも緩衝マット３）の保持部分を形成する工程を含むもので、管素材の筒状部材１５は図１２の縮径加工の場合と同様であるが、筒

状部材１５の必要内径は、後述する拡径加工後の内径よりも小径に設定される。拡径加工の工程（ａ）では、筒状部材１５に対し、メカニカル、弾性体、液圧等によるエキスパンディング加工、拡径スピニング加工等の塑性加工を行い、略中央の緩衝マット３保持部分（予定範囲）の全長に亘って、内径調整部たる拡径部２２、テーパ部１９及び大径の開口部２５を有する形状に成形する。この拡径加工においても、必要に応じて外側拘束型を使用するとオーバーシュート問題が発生し難く、拡径精度が一層向上する。

【００４６】ここでも、拡径部２２における内側の半径がＬであるという点が重要であり、内側の半径がＬとなるように拡径部２２を形成するものである。また、この拡径加工においても、測定工程にてコントローラＣＴ内に記憶された距離Ｌの値を用いて自動的に拡径装置（図示せず）を制御するように構成してもよいし、コントローラＣＴによって表示された距離Ｌの値を見て拡径装置の目標値として入力するように構成してもよい。あるいは、直接作業者によって拡径作業を行なうこととしてもよい。尚、拡径部２２が形成されるのであれば、その残部形状および全体形状は問わない。本実施形態においても、テーパ部１９及び大径の開口部２５が不要であれば全長に亘って一様に拡径することとしてもよい。

【００４７】次いで圧入工程（ｂ）に移り、大径の開口部２５から一体品４を挿入し、所定位置に至るまで圧入する。この場合も、テーパ部１９が圧入ガイドとして機能するため、従来の圧入法のような圧入治具を用いる必要がなく、圧入治具にまつわる不具合は発生しない。而して、圧入工程（ｂ）による一体品４の保持完了後は、拡径部２２内に緩衝マット３が設計ＧＢＤ値を保って圧縮挟持され、設計面圧にて触媒担体２が保持される状態が実現されたこととなる。この後、触媒コンバータ製品とする製品化工程（ｃ）が行なわれるが、これは図１２の工程（Ｃ）と同様であるので、説明は省略する。

【００４８】尚、上記のネッキング部２０及び２１は、必ずしも筒状部材１５と一体的に形成する必要はなく、別部品を溶接等で接続することとしてもよく、螺合締結とし脱着可能にしてもよい。また、上記の縮径加工及び拡径加工は、触媒コンバータにおける製造方法における工程例であるが、前述のＤＰＦを製造する場合には、触媒担体に代わり、柱体としてフィルタ（図示せず）が用いられることになるだけで、工程自体には殆ど差異はない。更に、前述の測定工程と圧入工程は必ずしも連続して行なう必要はなく、時間及び場所を異にして行なうこととしてもよい。例えば、ある工場で測定工程が行なわれた一体品４を、別の工場で筒状部材１５内に圧入することとしてもよい。

【００４９】

【発明の効果】本発明は上述のように構成されているので以下に記載の効果を奏する。即ち、請求項１乃至４に記載の柱体保持装置の製造方法においては、柱体の外径の誤差、筒状部材の内径の誤差、緩衝部材の誤差等に影響されることなく、筒状部材の少なくとも緩衝部材を保持する部分を縮径又は拡径して適切な内径に調整することができる。特に、最終的には、変数が、柱体の軸芯と筒状部材との間の距離のみということになり、必ず最適値を設定することができ、これを筒状部材の縮径又は拡径に反映することができる。従って、筒状部材内に緩衝部材を介して柱体を適切に保持した柱体保持装置を、迅速且つ容易に製造することができ、製造コストも低減することができる。

【００５０】また、請求項５に記載の柱体保持装置の製造方法によれば、上記の効果に加え、緩衝部材を巻回した柱体を筒状部材に容易に圧入することができ、製造時間を大幅に短縮することができるので、一層迅速且つ容易に製造することができる。

【図面の簡単な説明】

【図１】本発明の一実施形態に係る製造方法が対象とする触媒コンバータにおける触媒担体とこれに巻回される緩衝マットを示す斜視図である。

【図２】本発明の一実施形態に係る製造方法の測定工程を示す側面図である。

【図３】本発明の一実施形態に係る製造方法における測定状態を示す側面図である。

【図４】本発明の一実施形態に係る製造方法の測定工程の別の例を示す斜視図である。

【図５】本発明の一実施形態に係る製造方法の測定工程に供する多点測定装置の第１実施例を示す平面図である。

【図６】本発明の一実施形態に係る製造方法の測定工程に供する多点測定装置の第１実施例を示す正面図である。

【図７】本発明の一実施形態に係る製造方法の測定工程に供する多点測定装置の第２実施例を示す平面図である。

【図８】本発明の一実施形態に係る製造方法の測定工程に供する多点測定装置の第２実施例を示す正面図である。

【図９】本発明の一実施形態に係る製造方法の測定工程に供する多点測定装置の第３実施例を示す平面図である。

【図１０】本発明の一実施形態に係る製造方法の測定工程に供する多点測定装置の第３実施例における一部の作動状態を示す平面図である。

【図１１】本発明の一実施形態に係る製造方法の測定工程に供する多点測定装置の第３実施例における押圧体の別の例を示す平面図である。

【図１２】本発明の一実施形態に係る製造方法における縮径工程、圧入工程及び製品化工程を示す一部断面図である。

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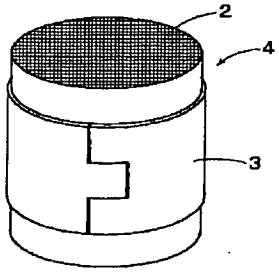
【図１３】本発明の他の実施形態に係る製造方法における拡径工程、圧入工程及び製品化工程を示す一部断面図である。

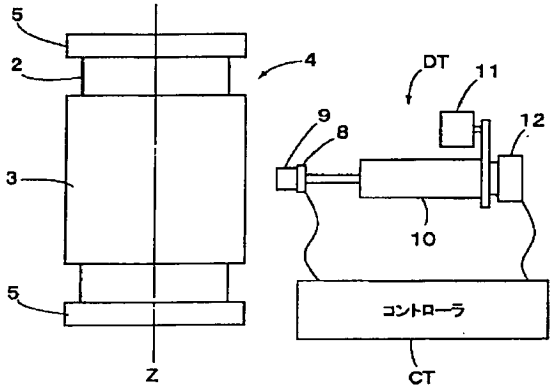
【符号の説明】

＊２　触媒担体，　３　緩衝マット，　４　一体品，　Ｄ　Ｔ　測定装置，５　クランプ装置，　８　ロードセル，　９　押圧体，１０　アクチュエータ，　１２　ロータリエンコーダ，１６　縮径部，　２２拡径部

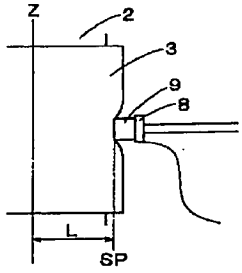
【図１】



【図２】



【図３】



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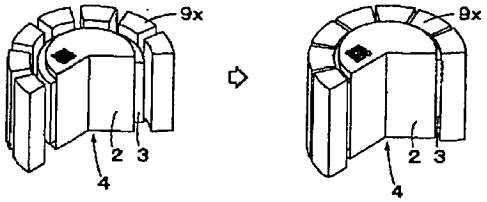

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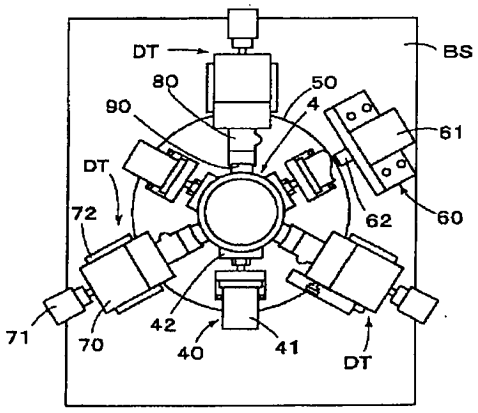

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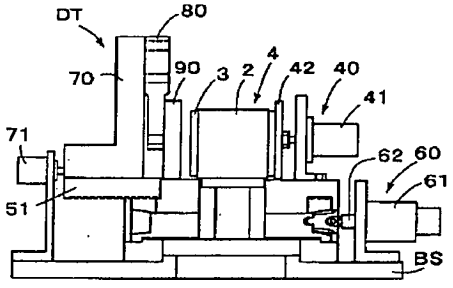

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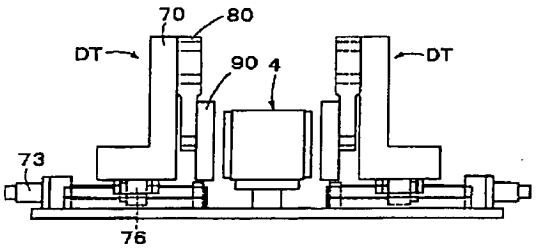

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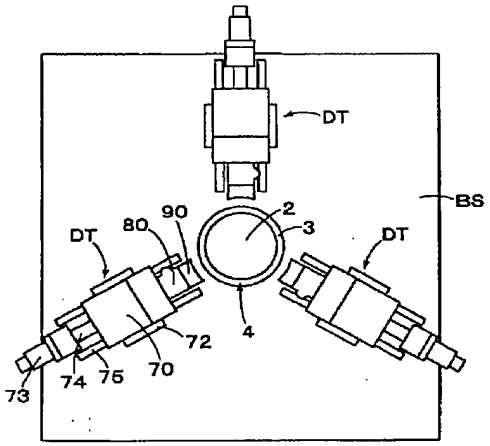

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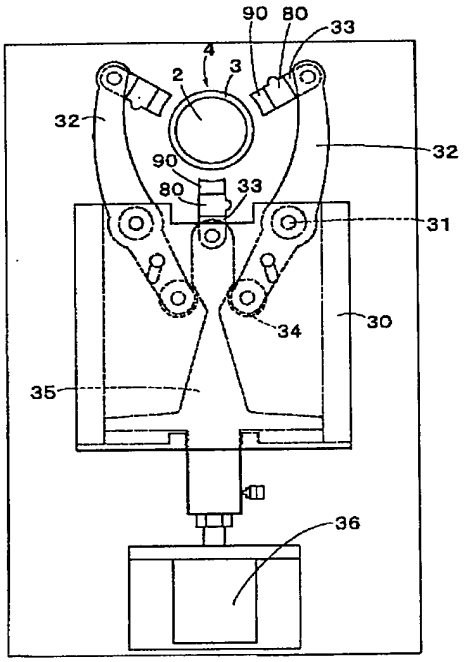

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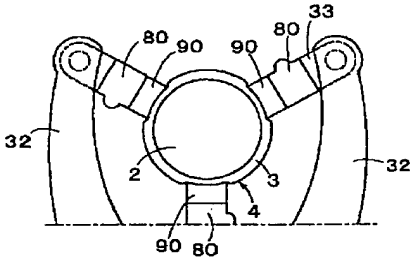

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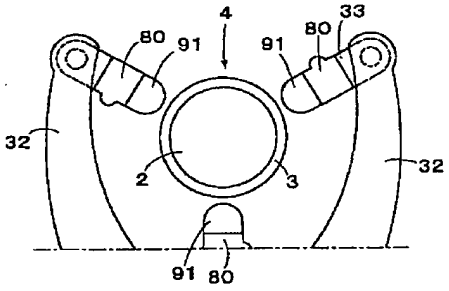

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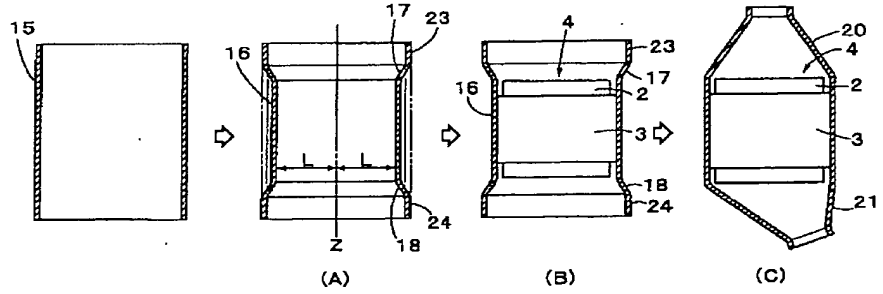

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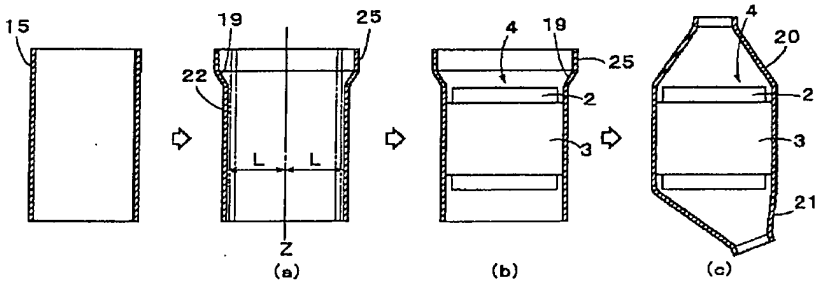

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